NOTA BREVE

COMPARATIVE UTILISATION OF HIGH INCLUSION RATES OF FOUR AGRO-INDUSTRIAL BY-PRODUCTS IN THE DIETS OF EGG TYPE CHICKENS

UTILIZACIÓN COMPARATIVA DE CUATRO SUBPRODUCTOS AGROINDUSTRIALES A ALTAS DOSIS EN LAS DIETAS DE PONEDORAS

Odunsi, A.A.[1], T.O. Akande[1], A.S. Yusuph and R.I. Salami[2]

[1]Department of Animal Production and Health. Ladoke Akintola University of Technology. PMB 4000, Ogbomoso. Nigeria.
[2]Department of Agricultural Education (Animal Science Division). St Andrew's College of Education. P.M.B.1010, Oyo. Nigeria.

ADDITIONAL KEYWORDS

Nutrition. Poultry. Feed resources.

PALABRAS CLAVE ADICIONALES

Nutrición. Aves. Recursos alimenticios.

ABSTRACT

Layer diets containing palm kernel cake (PKC), brewers dried grains (BDG), maize bran (MB) and wheat bran (WB) at 30 percent were compared to a maize/groundnut cake (control: CD). Feed intake was significantly ($p<0.05$) enhanced on by-product (AIBP) diets while weight gain was not affected. Layers on MB, WB, and CD had similar egg production rate and feed per kg egg whereas these parameters were depressed ($p<0.05$) in layers fed PKC and BDG. Layers fed AIBP diets recorded heavier egg size; larger shell surface area; normal internal egg qualities and maintained yield of egg components but had thinner ($p<0.05$) egg shells. MB and WB could be considered as substitutes for maize in layer diets but PKC and BDG should be cautiously used.

RESUMEN

Dietas de ponedoras con torta de semilla de palma (PKC), residuos de cervecería desecados (BDG) y salvados de maíz (MB) y trigo (WB), al 30 p.100 fueron comparadas con otra (CD) a base de maíz/torta de cacahuete. Con los subproductos (AIBP) aumentó la ingestión de pienso ($p<0,05$) pero no la ganacia de peso. La puesta y pienso consumido por kg de huevos con MB, WB y CD fueron similares y menores ($p<0,05$) con PKC y BDG. El consumo de AIBP determinó huevos mayores, más superficie de cáscara y calidades internas normales, manteniéndose las proporciones de los componentes del huevo, aunque las cáscaras fueron más delgadas. MB y WB podrían sustituir al maíz en las dietas de ponedoras pero PKC y BDG deben ser empleados con precaución.

INTRODUCTION

Ologhobo (1992) highlighted the problems facing animal feed and poultry production in the tropics; amongst which is poor feed quality and escala-

ting prices. Various studies have delved in to the area of grain substitution by agro-industrial byproducts (AIBPs), not directly used by man, in animal diets (Farrell, 1997). However, information appears minimal on comparative evaluation of AIBPs and, inclusion at high concentrations for egg-type poultry. With these in mind, palm kernel cake (PKC), brewers dried grains (BDG), maize (MB) and wheat brans (WB) were evaluated for their grain replacement value, and to provide comparative data on layers performance and egg quality parameters.

MATERIALS AND METHODS

Palm kernel cake (PKC) was obtained as a by-product of press oil extraction and brewers dried grains (BDG), from a mixture of barley and sorghum. Maize (MB) and wheat brans (WB) were by-products of maize (starchy-amylose rich type) and hard wheat *(Triticum aestivium)* millings. MB is the outer coating of the kernel, with little or none of the starchy part or germ. WB comprises of the outer covering of the wheat kernel and some parts of the germ. Each AIBP: PKC, BDG, MB and WB was analyzed for proximate contents (AOAC, 1990) and incorporated at 30 percent to formulate a layers diet in comparison to a control diet (CD) based on maize-groundnut cake **(table I)**. Sixty, 48 weeks old black harco layers were allotted at random to five groups of 12 birds per treatment, each subdivided into three replicates of four birds. Diets and water were offered *ad libitum* for 70 days and weekly data taken on feed intake, egg production rate, body weight and egg weight. Egg quality was assessed by measuring shell thickness, yolk index, Haugh unit, shape index, shell surface area and egg components. Data were subjected to analysis of variance and the multiple range tests of Duncan was utilised to locate significant differences (Daniel, 1991).

RESULTS AND DISCUSSION

BDG and PKC contained the highest crude protein followed by WB and MB

Table I. *Composition (percent) of diets.* (Composición (p.100) de las dietas).

	Control	PKM	BDG	MB	WB
Maize	61.35	40.00	42.75	36.95	34.75
GC	22.40	13.75	11.00	16.80	19.00
AIBP	-	30.00	30.00	30.00	30.00
Concentrate[1]	16.25	16.25	16.25	16.25	16.25
methionine[2]*	0.53	0.60	0.54	0.52	0.53
lysine[2]*	0.82	0.84	0.91	0.81	0.99
c. protein*	16.50	16.42	16.62	16.69	16.44
ether extract*	5.18	6.09	5.37	5.31	5.03
c. fiber*	3.83	4.96	4.35	4.24	4.02
ash*	9.72	9.48	5.34	7.42	7.28
ME[2]**	11.50	10.18	10.41	11.24	10.04
Proximate contents (percent) of AIBPs					
Dry Matter		93.29	90.33	92.16	92.35
Crude Protein		17.97	20.81	12.58	15.45
Ether Extract		8.39	3.36	5.12	2.32
Ash		5.24	4.13	3.32	3.26
Crude Fibre		10.31	12.86	8.42	6.04

GC: Groundnut cake. *percent DM; **MJ/kg.
[1]Concentrate contained: 3.5 percent fish meal; 9.0 percent oyster shell; 3.0 percent bone meal; 0.25 percent methionine; 0.25 percent sodium chloride and 0.25 percent vitamin-mineral premix (Ojewola and Longe, 2000). [2]Calculated.

while the crude fiber values are in the order of BDG, PKC, MB and WB. Productive performance **(table II)** showed a significant increase ($p<0.05$) in consumption for layers fed AIBP diets over CD, and intake was in the order PKC, WB, MB and BDG. AIBP at 30 percent caused a dilution of the energetic component of the diet thus making the birds to consume more feed in an attempt to meet their energy requirements for body maintenance and egg production (Ojewola and Longe, 2000). Layers on MB or WB had the best egg production rate and feed per kg egg similar to CD but PKC and BDG recorded the poorest values. Apparently, the higher total feed and protein intakes in layers fed BDG and especially PKC did not translate to better egg production over CD. PKC is less palatable, gritty in nature and has a lower biological value (Onwudike, 1986) than groundnut cake. BDG, on the other hand, is the solid residue of a fermentation process that may contain dried microbial remnants hence should have a better amino acid profile to support egg production than the other AIBPs. However, the reverse was the

Table II. *Productive performance and egg quality traits of layers fed diets containing AIBPs.*
(Rendimiento y calidad del huevo en ponedoras alimentadas con dietas a base de AIBP).

Parameter	Control	PKM	BDG	MB	WB	SEM
Performance						
Feed intake, g/d	114.3^{c}	129.4^{a}	117.8^{b}	123.6^{a}	126.7^{a}	1.88
Protein intake, g/d	18.9^{c}	21.3^{a}	19.6^{b}	20.6^{a}	20.8^{a}	0.94
Methionine intake, g/d	0.61^{b}	0.78^{a}	0.64^{b}	0.64^{b}	0.67^{b}	0.01
Lysine intake, g/d	0.98^{c}	1.09^{b}	1.07^{b}	1.01^{bc}	1.25^{a}	0.02
Egg production rate, percent	61.8^{a}	52.8^{b}	44.8^{c}	62.3^{a}	62.3^{a}	3.20
Feed per kg egg	2.93^{c}	3.67^{c}	3.98^{a}	3.09^{c}	3.11^{c}	0.23
Weight gain, g/d	3.84	3.86	3.31	5.63	4.55	0.38
Egg quality						
Haugh unit, percent	74.1	76.3	75.8	74.3	74.4	1.35
Egg weight, g	63.4^{bc}	67.6^{a}	66.3^{a}	64.4^{b}	66.1^{a}	0.66
Shell thickness, mm	0.34^{a}	0.32^{b}	0.30^{bc}	0.31	0.32^{b}	0.01
Yolk index	0.46	0.47	0.45	0.44	0.47	0.03
Albumen: yolk	2.11	2.30	2.28	2.34	2.39	0.34
Egg shape index, percent	76.0	70.1	69.4	74.7	75.1	2.14
Egg shell surface, g/cm^{3}	74.3	77.8	76.7	75.2	76.6	2.78
Shell weight, g	11.2	12.5	11.8	11.3	11.7	0.72
Adjusted percent yolk	32.2	30.9	29.4	31.6	30.0	1.45
Adjusted percent albumen	67.8	70.9	67.0	73.8	71.9	1.97

^{a,b,c}means with different superscripts on the same row are significantly different ($p<0.05$).
Albumen weight= Initial whole egg weight – [yolk + dry shell weight] x 100.
Adjusted percent yolk= [yolk weight/(initial whole egg weight - dry shell weight)] x 100.
Adjusted percent albumen= [albumen weight/(initial whole egg weight-dry shell weight)] x 100.

case. BDG is produced wet in the factory, the nature of which encourages fungal growth that becomes detrimental to the performance of the consuming subjects. Improper drying and processing may therefore counteract any positive effect conferred on it by the high amino acid and crude protein values reported by Aning *et al.* (1998).

Data (not shown) on Haugh unit, yolk index, shell surface area, egg yield components and albumen/yolk ratio were not affected by dietary treatments. AIBP fed layers have a larger egg size that may be related to some unidentified egg size factors present within the bran and aleurone layer (Uko *et al.*, 1990; Ojewola and Longe, 2000). Indeed, egg weight was even heavier for PKC and BDG, an indication of the negative correlation between egg weight and egg number (Morris, 1985). Dietary fibre sources high in non-starch polysaccharides probably through the carboxyl groups of the uronic acids can bind divalent cations such as Ca, Fe, Cu and Zn. This could have an adverse effect on the digestion of some dietary components (Kelsay, 1986) and might be the reason for the thin eggshells recorded on AIBP based diets. This condition may predispose eggs to greater breakage and cause higher economic losses to producers unless such diets are supplemented with extra calcium and phosphorus.

Layers on MB and WB achieved a comparable performance with control diet, whereas diets containing PKC and BDG should be cautiously fed. AIBPs will continue to be relevant in tropical monogastric animal diets because they are cheaper, abundant and has little or no human dietary value.

REFERENCES

Aning, K.G, A.G. Ologun, A. Onifade, J. A. Alokan, A. I. Adekola and V. A. Aletor. 1998. Effect of replacing dried brewers grain with sorghum rootlets on growth, nutrient utilisation and some blood constituents in the rat. *Anim. Fed Sci. and Tech.,* 71: 185-190.

AOAC (1990). Official methods of Analysis 15th edition, Washington D.C.

Daniel, N. W. 1991. Biostatistics: A foundation for analysis in the Health Sciences John Wiley and Sons, New York.

Kelsay, J. L. 1986. Update on fibre and mineral availability. In Vahouny G. and D. Kritchevsky, eds. Dietary fibre: Basic and Clinical aspects. New York Plenum Press pp 361-372.

Ojewola, G.S. and O. G. Longe. 2000. Evaluation of the productive and economic efficiencies of cowpea hull and maize offal inclusion in layers' ration. *Nig. J. Anim. Prod.,* 27: 35-39.

Ologhobo, A. D. 1992. The dilemma of animal feeds and indigenous poultry production in Nigeria. Proc. 19th World's Poultry Congress. Amsterdam. The Netherlands, 20-24 Sept. 1992, pp 81-86.

Onwudike, O.C. 1986. Palm kernel meal as a feed for poultry 1.Composition of palm kernel meal and availability of its amino acid to chicks. *Anim. Feed Sci Technol.,* 16: 179-186.

Uko, O.J., P. Awoyeseku and G.M. Babatunde. 1990. Substitution value of maize offal for maize in diets of laying hens. *Nig. J. Anim. Prod.* 17: 56-59.

Recibido: 7-10-01. Aceptado: 19-4-02.